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Title: BAR FOR PURLIN

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ABSTRACT:

A metal bar of J cross section adapted to act in an inverted position as a purlin, said bar when acting as a purlin having a main web 11 from the upper longitudinal edge of which a single transverse web 12 having a downturned edge lip 13 projects to one side and from the lower longitudinal edge of which a pair of generally coplanar webs 15 and 16 respectively project to opposite sides of the main web. The purlin 10 is made by cold rolling a steel sheet, the pair of coplanar opposed transverse webs 15 and 16 being formed by folding back the steel sheet beneath one said transverse web to project beneath the bottom of the main web to the other side of the latter. An insulated roof structure is described when parallel inverted J purlins are used to support angle section members extending perpendicularly between said purlins to form a lattice of peripheral frames for supporting roofing sheets.

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(54) Bar for Purlin

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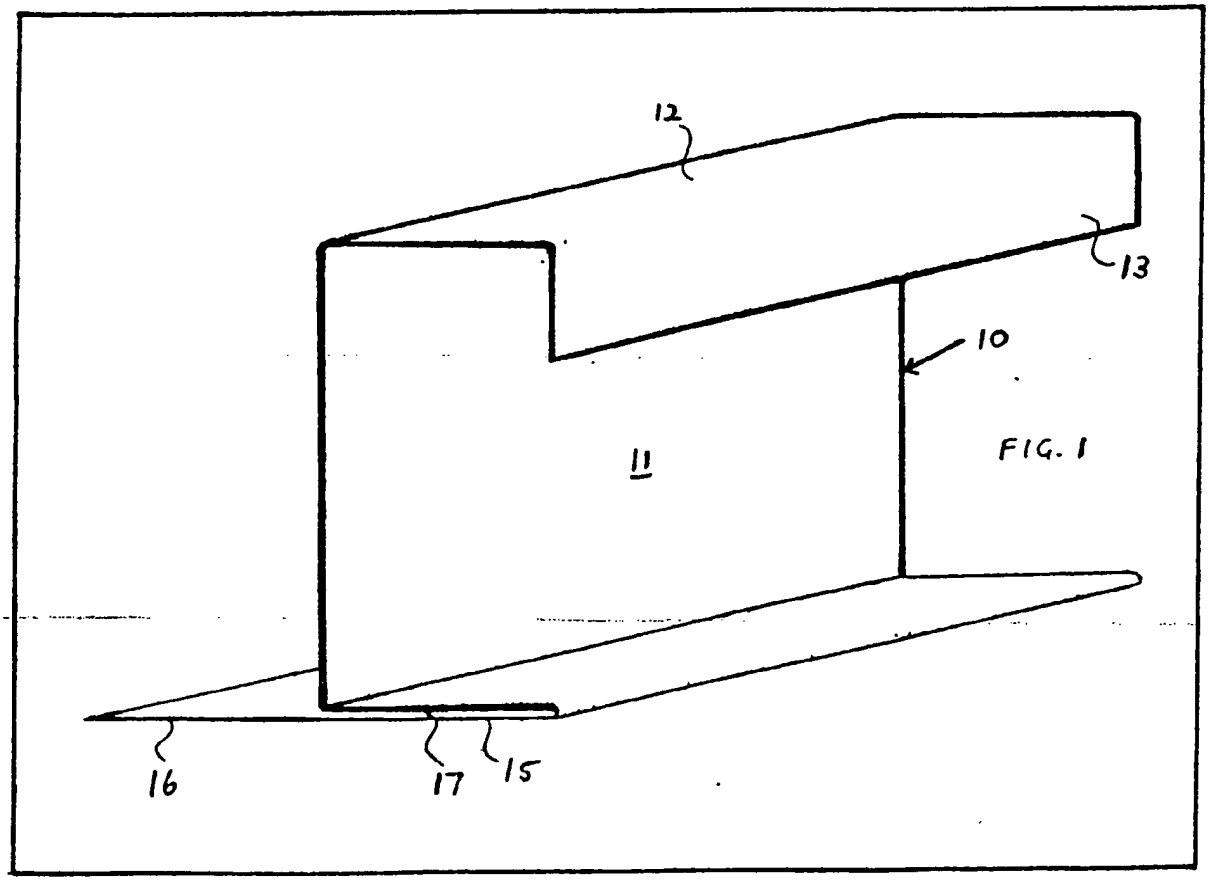

FIG. 1

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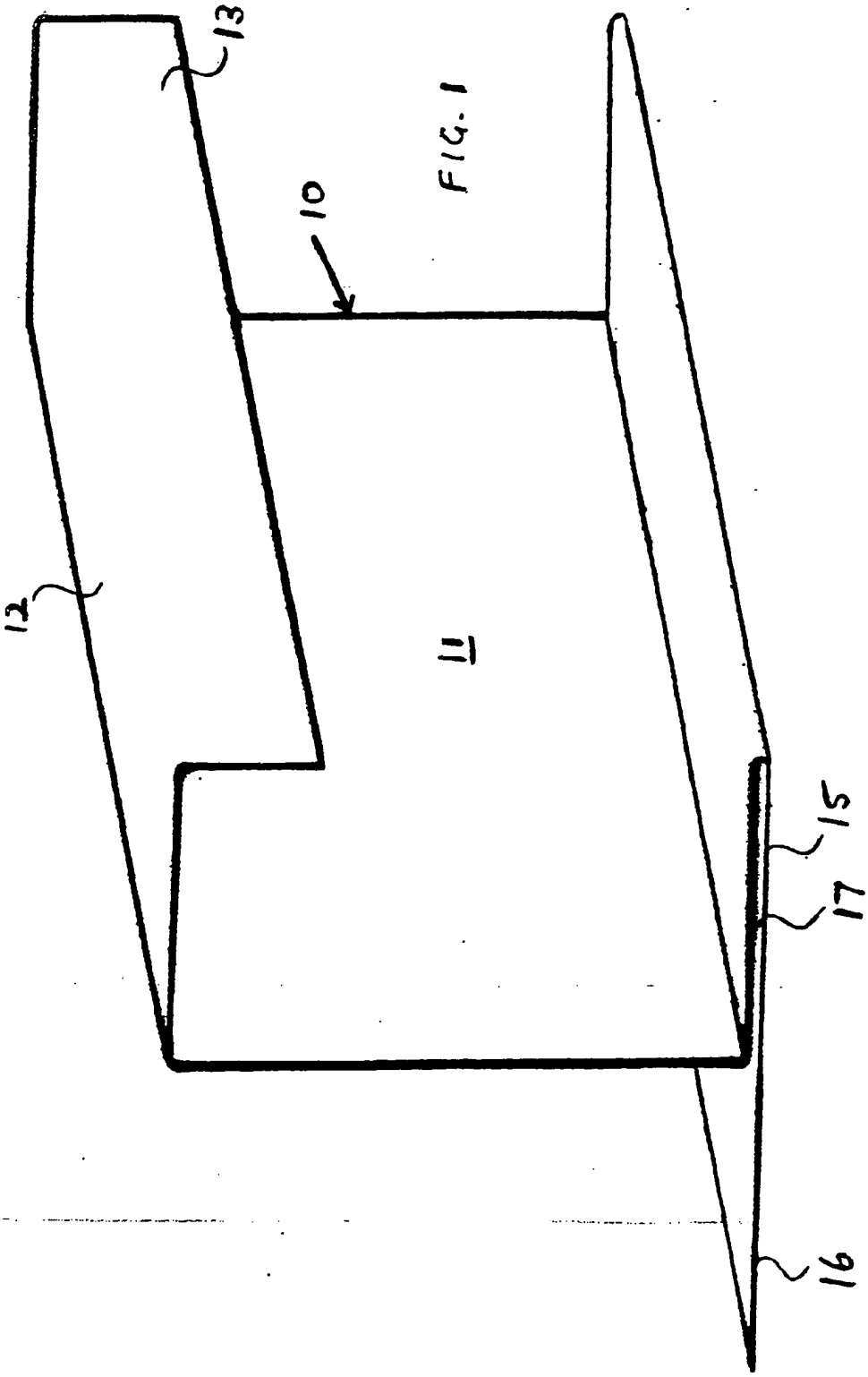

FIG. 1

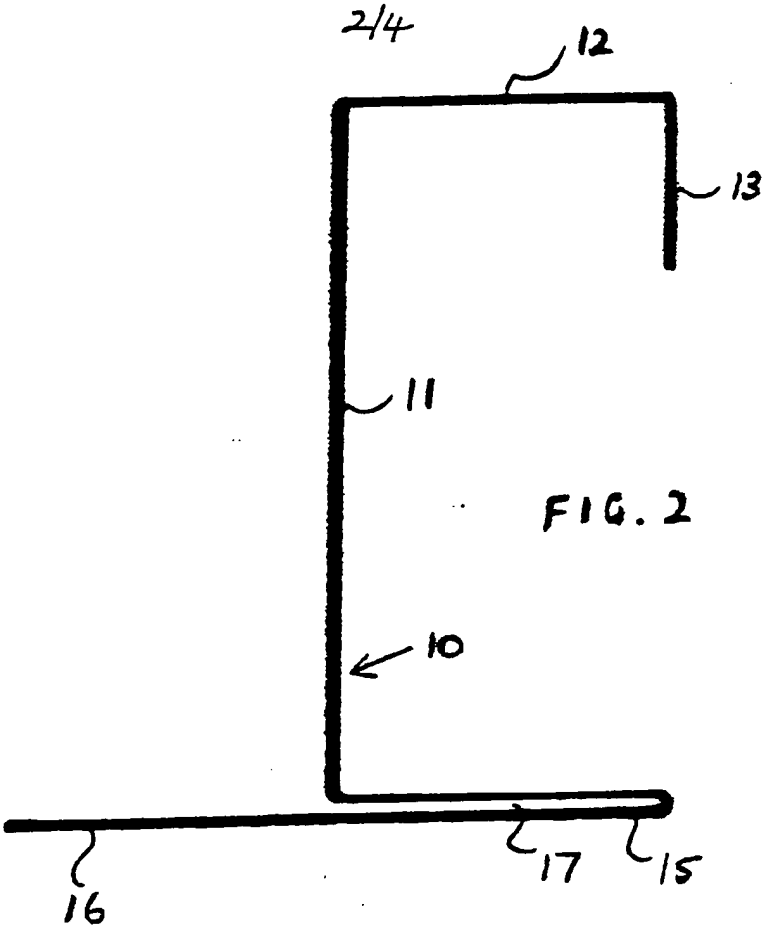

FIG. 2

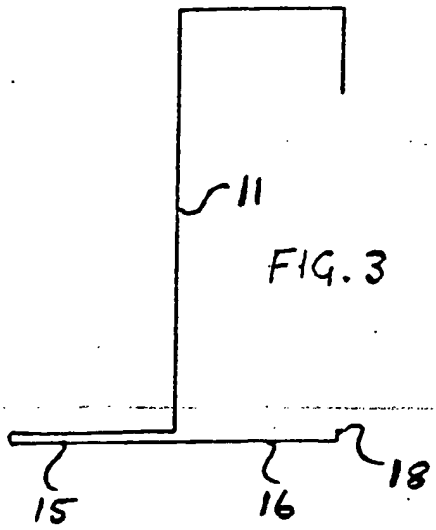

FIG. 3

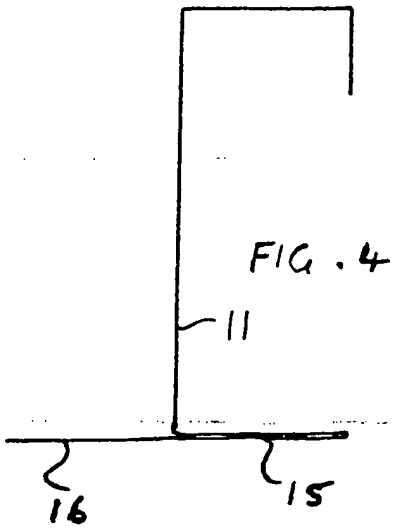

FIG. 4

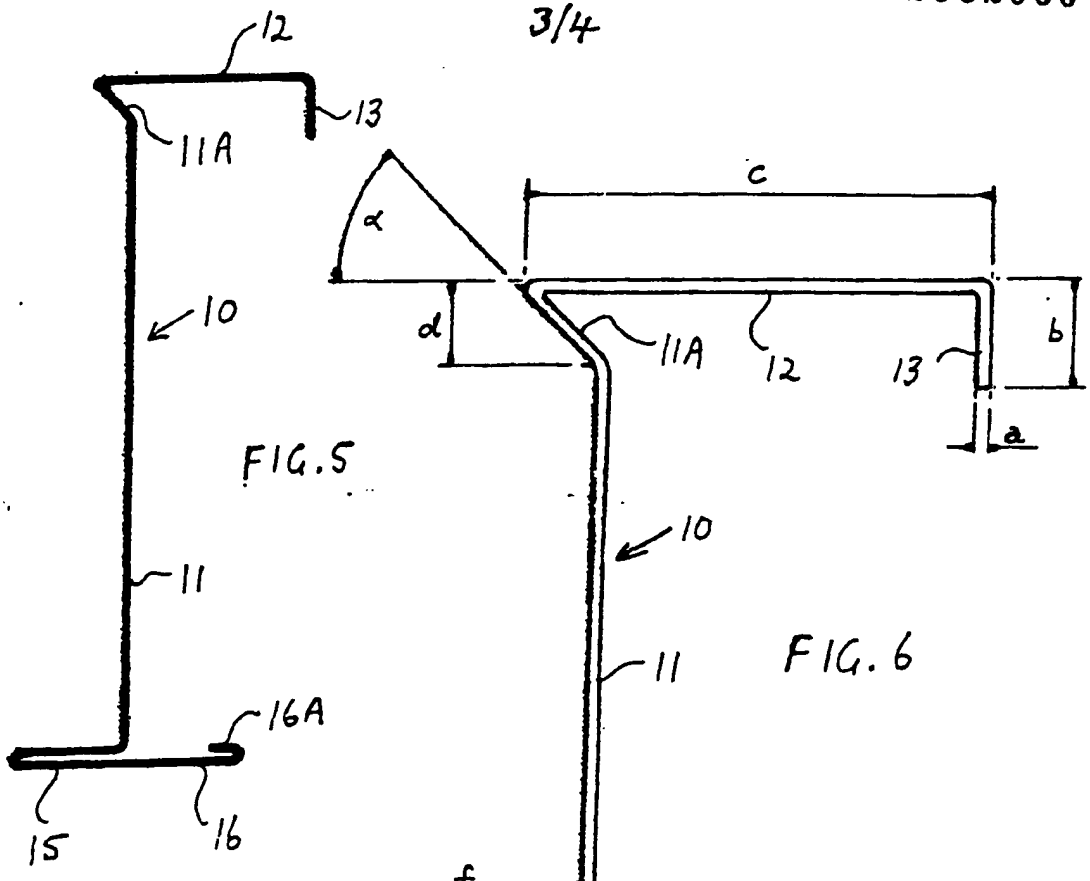

FIG. 5

FIG. 6

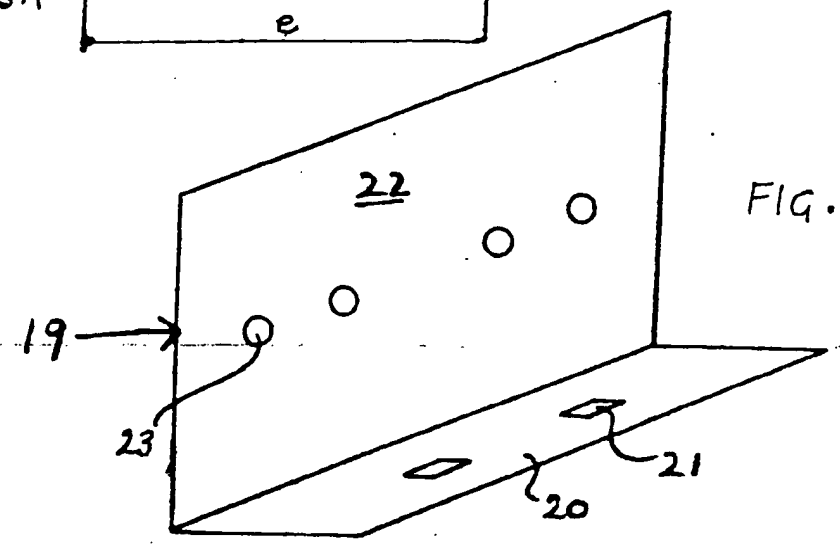

FIG. 7

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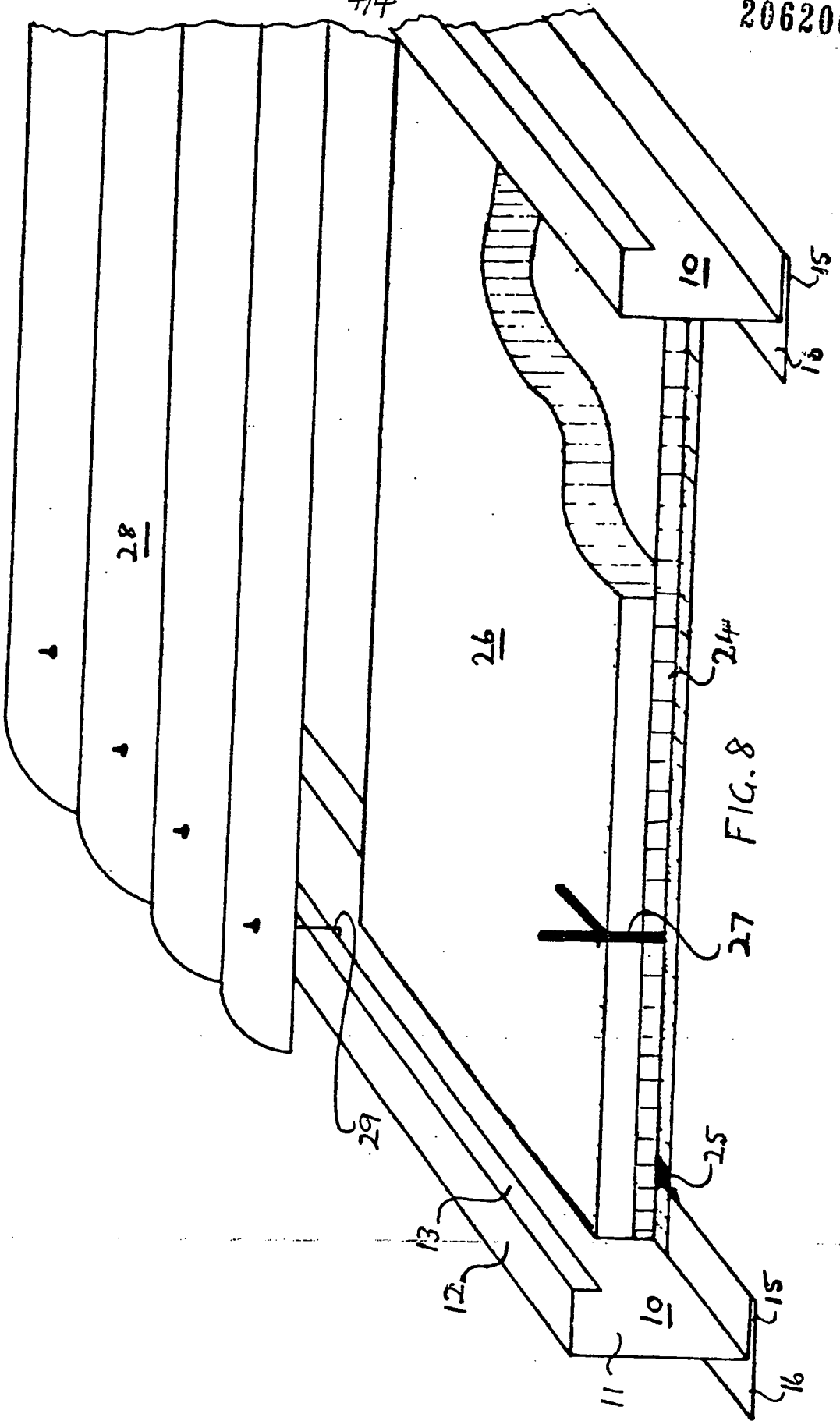

FIG. 8

SPECIFICATION

Improvements in or Relating to Bars for Use as Purlins and Rails in Roof Structures

This invention relates to a metal bar for use as a purlin or eaves rail and also to a roof structure in which the purlins or rails are incorporated.

In roofing structures for warehouses, animal houses or like industrial buildings often of substantial area, the outer skin is usually formed by roofing sheets, e.g. asbestos sheets, which are clamped by means of hook members to the turned back edges of the upper webs of the purlins. Conventionally, the purlins have a Z-shaped cross-section, and are often known as Z purlins.

At the present time, there invariably exists a requirement to incorporate insulation in the roof structure, and it has been the usual practice to fix this insulation under the outer roofing sheets, supported by suitable inner roofing sheets, the respective layers all being clamped in position over the tops of the purlins by means of long-stemmed hook members.

As higher standards of insulation are demanded, it is also necessary to employ spacers to create an air gap between the insulating layer and the outer skin of the roof, and sometimes to provide a very thick insulating layer in addition. This means that the hook members which fix the roof layers to the purlins must be further increased in length.

However, as the insulated roof becomes more complex, bulkier and heavier, an increased strain is placed on the Z purlins and on the hook-shaped members, especially in view of the increased length of the stems of the latter. The purlins are increasingly liable to twist, and the entire roof structure has a tendency to instability.

A system of the above-described kind is known as an over-purlin roof structure. So-called under-purlin systems are also known, providing a neater internal finish, but these latter systems are relatively complex and expensive, since a relatively elaborate arrangement is required to suspend the internal insulating roof layer from and below the bottom webs of the purlins.

It is an object of the present invention to provide a solution to the problems created by the present day requirement to construct highly insulated roof structures.

According to one aspect of the present invention, there is provided a purlin or rail in the form of a metal bar having a main web extending between transverse webs perpendicular to the main web at the respective opposite longitudinal edges of the latter, wherein at one said longitudinal edge a single transverse web projects laterally only to one side of the main web and has a longitudinal outer edge portion turned back parallel to the main web, while at the other said longitudinal edge two generally coplanar transverse webs respectively project laterally to opposite sides of the main web.

It is to be understood that the term "main web" is not restricted to a completely planar construction of such web. For strengthening and stiffening purposes, the main web may incorporate angled portions and bends deviating from the basic plane of such web, as for example known from the so-called multi-beam Z purlin.

The purlin or rail of the invention inherently has greater resistance to twisting than the conventional Z purlin, due to the provision of the pair of coplanar webs projecting to both sides of one longitudinal edge of the main web. In addition, however, this pair of webs makes possible an improved arrangement of the layers of the insulated roof.

Thus, according to a second aspect of the invention, there is provided an insulated roof structure having a plurality of the above-defined metal bars acting as purlins fixed in parallel relationship with the pair of coplanar webs on the underside, a plurality of angle section members, in particular of inverted T-section, supported between the facing limbs of the double webs of two adjacent purlins to extend in parallel relationship perpendicularly to said purlins, thereby to define a plurality of rectangular trays with a peripheral base formed by the respective webs of the purlins and the angle section members, inner roofing sheets laid in said trays and outer roofing sheets fixed over the tops of the purlins by means of hook members engaging with the turned back edge portions of the upper transverse webs of said purlins. This system constitutes an inter-purlin roof structure, as distinct from the over-purlin and under-purlin systems previously referred to.

It should be made clear, however, that the metal bar of the invention is not restricted to use as a purlin in this manner. When turned through 90 degrees about its longitudinal axis, the metal bar is especially useful as a roof supporting rail at the eaves of a building, and can be employed with advantage in this situation even when the main part of the roof structure is supported by conventional Z purlins.

Some practical examples of metal bar and roof structure in accordance with the invention will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 shows a metal bar in perspective view;

Figure 2 is a transverse cross-section through the metal bar of Figure 1;

Figures 3 and 4 show modified constructions of metal bar;

Figure 5 shows a preferred construction of metal bar in transverse cross-section;

Figure 6 shows one practical form of the preferred construction with the parts thereof in dimensionally scaled relationship for use as a purlin or eaves rail;

Figure 7 shows a stiffening and joining bracket for two end abutting bars; and

Figure 8 shows an insulated roof structure in cut-away section.

Referring first to Figures 1 and 2, a metal bar in accordance with the invention is generally designated by the reference 10. The bar 10 has a main web 11 and a transverse web 12 projecting perpendicularly to one side of the main web from one longitudinal edge of the latter. The outer edge portion 13 of the transverse web 12 is turned back parallel to the main web, as is also the case with a conventional Z purlin. However, unlike the conventional Z purlin, the metal bar 10 of the invention has a pair of webs 15 and 16 extending perpendicularly to the main web 11 at the other longitudinal edge of the latter. This pair of webs 15 and 16 respectively project to opposite sides of the main web 11 in a common plane.

In practice, the metal bar is made of cold rolled steel, so that the pair of webs 15 and 16 are formed in the manner shown in Figures 1 and 2, by folding back the steel sheet beneath itself to form the limb 15, the sheet then extending continuously beneath the main web 11 to form the limb 16. This construction can sometimes be especially advantageous when, as shown, a narrow space 17 is provided between the folded back layers of the limb 15, as will be made clear later.

Unlike the conventional Z purlin, it is unnecessary to turn back the edge portion of the web 16 parallel to the main web 11, in like manner to the edge portion 13 of the transverse web 12. However, Figure 3 shows a modification in which the positions of the limbs 15 and 16 are reversed relative to the main web 11, and wherein the extreme edge of the web 16 is rolled over to form a stiffening lip 18. For the proposed use of the metal bar as a purlin in construction of an insulated roof structure, it is important that the stiffening lip 18 is of relatively minimal depth. In the construction of Figures 1 and 2, the extreme edge of the limb 16 may be similarly formed with a stiffening lip.

Figure 4 shows another modification, wherein the narrow space 17 in the limb 15 is omitted. In effect, the metal bar of Figures 1 and 2 is cold rolled with the layers of the limb 15 folded back in tight contact.

Figure 5 shows a preferred construction of cold rolled metal bar. In this case, the main web 11 includes an angled portion 11A connecting to the single transverse web 12 at an internal acute angle. The free longitudinal edge of the web 16 of the pair of coplanar double webs 15 and 16 is turned back parallel to itself for stiffening purposes, as indicated at 16A. The angled portion 11A is also important for stiffening purposes, and eliminates any inherent weakness which could arise at the juncture produced during cold rolling between the main web 11 and the transverse web 12.

In Figure 6, the preferred form of metal bar is shown with the parts in dimensionally scaled relationship to enable said bar to be structurally adapted for use as a purlin or eaves rail. The arcuately bent folded back edge 15A of the transverse web 15 is to be noted. This figure is marked with various dimensions *a*, *b*, *c* ... etc., and with the angle α at which the angled portion 11A connects to the transverse web 12. Dimension *a* represents the thickness of steel of which the metal bar is made; the other dimensions *b*, *c* ... etc. are dimensions mentioned in the transverse cross-section of the figure. The dimensions in question are as follows, all in millimetres for the practical construction referred to:—

α=45 degrees

a = 2	*d* =12	*g* =11
b =16	*e* =60	*h* = 8
c =70	*f* =34	*i* =10

The main web 11 may vary in depth (from transverse web 12 to transverse webs 15 and 16) according to requirements, and will generally be of the order of 100 to 150 mm. The bars will usually be produced in a length of 2 or 3 metres.

In a roof structure of large area, it will commonly be necessary to abut purlins end to end in order to span the roof. Figure 7 shows a stiffening and joining bracket, generally designated 19, which can be employed in such circumstances. The bracket 19 has a base web 20 with square apertures 21 and an upstanding web 22 with circular apertures 23. In use, the base web 20 of the bracket is partly received into the narrow space 17 at the end of the limb 15 of one purlin 10 of the construction of Figures 1 and 2 or Figure 3, leaving a projecting portion to be similarly received in the abutting end of the next purlin 10. The circular apertures 23 enable the upstanding web 22 of the bracket 19, which web 22 lies against the face of the main web 11 of the purlin 10 on the side of the limb 16, to be bolted to the main webs of the end-abutting purlins 10, thus joining the purlins together.

Alternatively, in the case of the preferred purlins of Figures 5 and 6, a generally similar bracket may be employed in an inverted condition so that its base web (now at the top) can be bolted or otherwise secured to the upper transverse webs 12 of two abutting purlins.

In practice, the purlins are themselves supported on and fixed to the main roof stanchions. For this purpose, square holes are formed in the upper layer of the limb 15, e.g. in alignment with the square apertures 21 in the base web 20 of the bracket 19, and coach bolts are employed to fix the purlins on the roof stanchions, with the square heads of the coach bolts at least mainly recessed into the aligned square holes and apertures 21, clamping the lower layer of the limb 15 tightly against the stanchion.

If desired, brackets 19 or similar brackets can be employed for stiffening and/or fixing purposes only. In general, however, stiffening cleats of the kind commonly employed with conventional Z purlins are unnecessary with the purlin constituted by the metal bar of this invention.

Reference is now made to Figure 8, showing an insulated roof structure. Two spaced parallel purlins are again designated by the reference 10, it being assumed that these purlins are fixed to suitable roof stanchions in the manner already described. As shown, the roof structure appears generally horizontal, but in practice will usually lie on a gable slope, inclined upwardly from left to right towards the roof apex in the drawing, thus materially increasing the twisting strain to which the purlins and their fixing points are subjected, especially when a heavy and bulky insulated roof is being supported. The arrangement of roof structure now to be described minimises roof instability which can arise due to this strain.

In Figure 8, the reference 24 denotes inverted T-section bars (of which only one is visible) supported between the facing webs 15 and 16 forming the underside of the purlins 10, the bars 24 extending in parallel relationship perpendicularly to said purlins 10. The bars 24 are fixed to the purlins 10 by clips 25. The purlins 10 and inverted T-bars 24 define a plurality of rectangular trays each having a peripheral base formed by the limbs 15 and 16 of two adjacent purlins and one side of the cross-web of each of two adjacent T-bars. Insulating panels 26 are laid in these trays and are held down by clips 27, which are conveniently adjustable to suit panels of differing thicknesses. Asbestos sheeting 28 is fixed down on top of the purlins 10 in the conventional manner, using hook members 29 which clamp to the turned back edge portion 13 of the upper transverse web 12 of at least some of the purlins. An insulating air space is created between the outer skin of the roof formed by the asbestos sheeting 28 and the insulating panels 26 which form a substantially continuous inner skin. However, the hook members 29 which are employed do not require to be long stemmed, since they are now again employed only to hold the outer skin in position.

In consequence of use of the improved purlins 10, and the avoidance of long stemmed hook members 29, the above-described roof structure has high stability. The purlins show materially reduced tendency to twist, and the fixing points thereto are subject to less strain. At the same time, a very high degree of heat insulation can be obtained by the provision of an appropriate layer of insulating material in conjunction with an air space. In particular, the arrangement permits an insulating layer of adequate thickness to be provided, and likewise an adequate air space, without any constraints imposed by the necessity to avoid the use of hook members of undue length, and without any compression of the insulating material which may be entailed by the use of spacers.

Claims

1. A metal bar adapted for use as a purlin or roof supporting rail, having a main web extending between transverse webs perpendicular to the main web at the respective opposite longitudinal edges of the latter, wherein at one said longitudinal edge a single transverse web projects laterally only to one side of the main web and has a longitudinal outer edge portion turned back parallel to the main web, while at the other said longitudinal edge two generally coplanar transverse webs respectively project laterally to opposite sides of the main web.

2. A metal bar according to claim 1, produced of cold rolled steel.

3. A metal bar according to claim 2, having its pair of coplanar transverse webs formed by folding the steel sheet laterally to one side of the main web in order to form one said transverse web and then back on itself beneath the said one transverse web and beneath the bottom edge of the main web to project to the opposite side of the latter in order to form the other said transverse web.

4. A metal bar according to claim 3, having a stiffening lip at the free edge of said other transverse web.

5. A metal bar according to claim 4, wherein said stiffening lip is formed by folding back the edge portion of said other transverse web above the main portion of said web towards the main web.

6. A metal bar according to any of claims 3 to 5, wherein the steel sheet is turned back on itself, beneath said one transverse web, with a smooth bend extending over an arc exceeding 180 degrees, and at one end of said smooth bend has a reverse bend bringing the folded back portion into parallel relationship with said one transverse web.

7. A metal bar according to claim 6, wherein inwardly of the main web and towards the main web, the said one transverse web and the folded back portion beneath it are substantially in contact.

8. A metal bar according to claim 7 when appendant to claim 5, wherein the stiffening lip on said other transverse web is folded back at a level corresponding to the level of the top of the said smooth bend above the said one transverse web.

9. A metal bar according to any of claims 2 to 8, wherein the main web includes an angled portion connecting its main portion to the single transverse web at the one longitudinal edge of the bar.

10. A metal bar according to claim 9, wherein the angled portion joins the said single transverse web at an internal acute angle, preferably of the order of 45 degrees.

11. A metal bar according to any of claims 2 to 5, wherein the steel sheet is folded back to create a small spacing with the said one transverse web.

12. A metal bar according to any of claims 1 to 11, having a portion turned down parallel t the main web at the longitudinal edge of the single transverse web.

13. An insulated roof structure having a plurality of metal bars according to any of claims 1 to 12 acting as purlins fixed in parallel

relationship with the pair of coplanar webs on the underside, a plurality of angle section members, in particular of inverted T-section, supported between the facing limbs of the double webs of two adjacent purlins to extend in parallel relationship perpendicularly to said purlins, thereby to define a plurality of rectangular trays with a peripheral base formed by the respective webs of the purlins and the angle section members, inner roofing sheets laid in said trays and outer roofing sheets fixed over the tops of the purlins by means of hook members engaging with the turned back edge portions of the upper transverse webs of said purlins.

14. A structure according to claim 13, including locating clips fixing the angle section members to the purlins.

15. A structure according to claim 13 or claim 14, including clips holding the inner roofing sheets down in the trays.

16. A structure according to any of claims 13 to 15, being a pitched roof, wherein the single transverse webs at the tops of the purlins are directed towards the roof apex.

17. A structure according to any of claims 13 to 16, using purlins constituted by metal bars according to claim 3 or any of claims 4 to 12 when appendant thereto, wherein, in each purlin, the said one transverse web having the folded back steel sheet beneath it is directed towards the roof apex.

18. A roof structure according to any of claims 13 to 17, wherein the edge of the roof structure is supported by an eaves rail constituted by a metal bar according to any of claims 1 to 12 orientated with its main web as a base web.

19. A metal bar substantially as hereinbefore described with reference to any of Figures 1 to 6 of the accompanying drawings.

20. An insulated roof structure substantially as hereinbefore described with reference to Figure 8 of the accompanying drawings.

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